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(54) GLASS SUBSTRATE FOR MAGNETIC RECORDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a new glass substrate for magnetic recording media and information recording media, high in Young's modulus and heat resistance, excellent in surface smoothness and surface uniformity, and high in mechanical strength.
SOLUTION: This glass substrate consists of oxycarbonitride glass such as Li-Si-O-N-C-based, Na-Si-O-N-C-based, Mg-Si-Al-O-N-C-based, or Ca-Si-Al-O- N-C-based glass, being, for example, ≥36 × 106 Nm/kg in specific elastic modulus, ≥100 GPa in Young's modulus, ≤8Å in surface roughness (Ra), and ≥700° C in glass transition temperature.

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The substrate for magnetic-recording media characterized by consisting of oxy-carbonite RAIDO glass.
[Claim 2] The substrate according to claim 1 characterized by a specific Young's modulus being more than 36x106 Nm/kg.
[Claim 3] Young's modulus is 100GPa(s). Substrate according to claim 1 characterized by being above.
[Claim 4] A substrate given in any 1 term of claims 1-3 whose surface roughness (Ra) is 8A or less.
[Claim 5] A substrate given in any 1 term of claims 1-4 whose glass transition points are 700 degrees C or more.
[Claim 6] Oxy-carbonite RAIDO glass A Li-Si-O-N-C system, a Na-Si-O-N-C system, A K-Si-O-N-C system, a Li-aluminum-Si-O-N-C system, a Na-aluminum-Si-O-N-C system, A K-aluminum-Si-O-N-C system, a Mg-Si-O-N-C system, a calcium-Si-O-N-C system, A Sr-Si-O-N-C system, a Ba-Si-O-N-C system, a Mg-aluminum-Si-O-N-C system, A calcium-aluminum-Si-O-N-C system, a Sr-aluminum-Si-O-N-C system, A Ba-aluminum-Si-O-N-C system, a Y-aluminum-Si-O-N-C system, A B-aluminum-Si-O-N-C system, a La-aluminum-Si-O-N-C system, A R-aluminum-Si-O-N-C system (R is a rare earth metal ion), a Ce-aluminum-Si-O-N-C system, Or a substrate given in any 1 term of claims 1-5 characterized by being the glass which consists of a presentation of a Si-O-N-C system, or glass which consists of a presentation which mixed two or more above-mentioned presentations.
[Claim 7] The substrate for information record media characterized by consisting of oxy-carbonite RAIDO glass.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the glass substrate for magnetic-recording media and the glass substrate for information record media which used oxy-carbonite RAIDO glass.
[0002]
[Description of the Prior Art] Conventionally, as a glass substrate for magnetic disks for which high intensity and high shock resistance are needed, the tempered glass substrate which strengthened the substrate front face with the ion-exchange method, the glass-ceramics substrate which performed crystallization processing are known. As a tempered glass substrate, there is a glass substrate for magnetic disks indicated by JP,1-239036,A, for example. This glass substrate is 50 - 65%, and aluminum 2O3 about SiO2 by weight % display. It is the glass substrate which formed the compressive-stress layer and was strengthened by the substrate front face of the glass which contains [R2O (however, R alkali metal)] B-2 O3 for ZnO 1.1 to 14% 1 to 15% 10 to 32% by the ion-exchange method by alkali ion 0.5 to 14%. Moreover, as a crystallization glass substrate, there is a glass-ceramics substrate for magnetic disks indicated by the U.S. Pat. No. 5391522 official report, for example. This glass substrate is 8 - 13%, and K2O about 65 - 83%, and Li2O in SiO2 by weight % display. They are 0 - 5%, and PbO about 0.5 - 5.5%, and ZnO in 0 - 7%, and MgO, 0 - 5% (however, MgO+ZnO+PbO 0.5 - 5%) They are 1 - 4%, and aluminum 2O3 about P2O5. 0 - 7%, and As2O3+Sb 2O3 It contains 0 to 2% and they are Li2O and 2SiO2 detailed as a main crystal. It consists of glass ceramics including a crystal grain child.
[0003]
[Problem(s) to be Solved by the Invention] However, in connection with the miniaturization of the latest HDD (Hard disk driver), thin-shape-izing, and the densification of magnetic recording, the reduction in floatation of the magnetic head and high-speed revolution-ization of a magnetic disk are progressing quickly. Therefore, the reinforcement of a disk substrate, an elastic modulus, surface smoothness, etc. have been required still more severely. It is inevitable that high-capacity-izing of HDD, a miniaturization, and the demand to a shock resistant will increase further from now on, and it is certain that the demand which thin-shape-izing, high intensity, the outstanding surface surface smoothness, high shock resistance, etc. receive as a substrate ingredient for magnetic-recording media increases further. Therefore, with conventional chemically strengthened glass which is indicated by the JP,1-239036,A official report, elastics modulus are about 80 GPa(s). There is a possibility that it may become impossible to correspond to the severe demand of future HDD with extent. Moreover, if the chemically-strengthened-glass substrate is not formed so that the stress layer of front flesh-side both sides may have homogeneity and equivalent stress, it has the fault which produces the curvature of a substrate. Furthermore, in the manufacture process of the medium of magnetic recording, after preparing a magnetic layer on a glass substrate, in order to raise properties, such as coercive force of a magnetic layer, predetermined heat treatment may be performed, but with the above-mentioned conventional ion-exchange tempered glass, since the transition point temperature of glass is also lacking in about 500 degrees C and thermal resistance, there is a problem that high coercive force is not acquired.
[0004] Moreover, the conventional glass ceramics which are indicated by the U.S. Pat. No. 5391522 official report excel the above-mentioned chemically-strengthened-glass substrate in the elastic modulus or the heat-resistant point a little. However, surface roughness is deficient in about at most 10A and surface smoothness at Ra, and a limitation is in low floatation-ization of the magnetic head. Therefore, in the conventional glass ceramics, there is a problem that it cannot respond to the densification of magnetic recording. Moreover, the magnetic-recording medium which, on the other hand, used glacis carbon which is indicated by the JP,3-273525,A official report excels an above-mentioned chemically-strengthened-glass substrate and an above-mentioned glass-ceramics substrate in the point of thermal resistance or lightweight nature, and high density record is expected. However, it is thought that glacis carbon has much surface discontinuity and cannot respond to high density record. Furthermore, an elastic modulus is 30x106 Nm/kg. It is dramatically as low as extent, and since it is inferior to a glass ingredient in respect of a mechanical strength, it is necessary to take the large thickness of a substrate, and there is a problem that it cannot respond to a miniaturization or thin-shape-izing of a substrate.
[0005] Then, this invention was made in consideration of the demand thin-shape-izing of the future substrate for magnetic-recording media, high intensity, high shock-proof one, high heat-resistant, Young's modulus and thermal resistance are high and this invention aims at excelling in surface smooth nature or surface homogeneity, and offering the new glass substrate for magnetic-recording media with large reinforcement. Young's modulus and thermal resistance of this invention are still higher, and also let it be the object to excel in surface smooth nature or surface homogeneity, and to offer the new glass substrate for information record media with large reinforcement.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned object, this invention is a substrate for magnetic-recording media characterized by consisting of oxy-carbonite RAIDO glass. Furthermore, this invention relates to the substrate for information record media characterized by consisting of oxy-carbonite RAIDO glass.
[0007]
[The mode of implementation of invention] The glass substrate of this invention is explained. Oxy-carbonite RAIDO glass is glass which contained a nitride and carbide on oxide glass, is also called acid carbon nitride (Oxycarbonitride) glass, and incorporates nitrogen ion and carbon ion in the structure. Oxy-carbonite RAIDO glass has the structure permuted with trivalent nitrogen ion and tetravalent carbon ion in some oxygen ion of the bivalence in oxide glass. For this reason, from oxide glass, many chemical bonds

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are formed between glass formers, and the network structure of glass becomes firmer. For this reason, it has the physical property which was [show / high Young's modulus a high degree of hardness, and high intensity] excellent, and has the property which was excellent as the substrate for magnetic-recording media, or a substrate for information record media.

[0008] The class of oxy-carbonite RAIDO glass, a component, and especially a presentation are not restricted. Oxy-carbonite RAIDO glass can change chemical composition continuously, and the element of most periodic tables goes into these structure of glass depending on an addition. Moreover, especially the nitrogen content and carbon content in oxy-carbonite RAIDO glass are not restricted, either. This is because physical properties may improve by leaps and bounds by physical properties improving by leaps and bounds with few nitrogen and carbon contents depending on a presentation system, and making [many] nitrogen and a carbon content at reverse, or considering as a suitable amount.

[0009] As for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint of high shock resistance to high intensity and a specific Young's modulus are more than 36x106 Nm/kg. For the substrate which furthermore consists of oxy-carbonite RAIDO glass of this invention, the viewpoint of high shock resistance to high intensity and Young's modulus are 100GPa(s). It is desirable that it is above. Moreover, as for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint of high surface smooth nature and surface homogeneity to surface roughness (Ra) is 8A or less. Moreover, as for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint that thermal resistance is high to a glass transition point is 700 degrees C or more. The glass which has each above-mentioned physical properties can be suitably chosen from the oxy-carbonite RAIDO glass illustrated below.

[0010] As oxy-carbonite RAIDO glass, for example A Li-Si-O-N-C system, A Na-Si-O-N-C system, a K-Si-O-N-C system, M-Si-O-N-C (M is alkaline earth metal), A Li-aluminum-Si-O-N-C system, a Na-aluminum-Si-O-N-C system, A K-aluminum-Si-O-N-C system, a Mg-Si-O-N-C system, a calcium-Si-O-N-C system, A Sr-Si-O-N-C system, a Ba-Si-O-N-C system, a Mg-aluminum-Si-O-N-C system, A calcium-aluminum-Si-O-N-C system, a Sr-aluminum-Si-O-N-C system, A Ba-aluminum-Si-O-N-C system, a Y-aluminum-Si-O-N-C system, A B-aluminum-Si-O-N-C system, a La-aluminum-Si-O-N-C system, A Y-Mg-aluminum-Si-O-N-C system, a R-aluminum-Si-O-N-C system (R is a rare earth metal ion), The glass of a presentation of a Nd-aluminum-Si-O-N-C system, a Ce-aluminum-Si-O-N-C system, and a Si-O-N-C system and the glass which consists of a presentation which mixed these two or more presentations can be mentioned. Especially as a glass substrate for magnetic-recording substrates, specific gravity is low in comparison, and Young's modulus is large. The Mg-aluminum-Si-O-N-C system which whose thermal resistance is high and does not have elution of alkali, A calcium-aluminum-Si-O-N-C system, a Y-Mg-aluminum-Si-O-N-C system, A Y-aluminum-Si-O-N-C system, a Mg-Si-O-N-C system, a calcium-Si-O-N-C system, It is desirable to use the glass of a presentation of an aluminum-Si-O-N-C system and a Ce-aluminum-Si-O-N-C system or the oxy-carbonite RAIDO glass which consists of a presentation which mixed these two or more presentations.

[0011] Especially concerning the manufacture approach of oxy-carbonite RAIDO glass, it is not restricted but the various manufacture approaches can be used. for example, melting — high temperature processing of the approach and porous glass which introduce ammonia and carbon dioxide gas into the inside of the body by bubbling is carried out with carbon dioxide gas, and the approach of making this nonporous, the sol-gel method, the CVD method, etc. are known. In addition, since many properties of oxy-carbonite RAIDO glass are influenced with the cooling rate of the class of compound used as the carbon source added as a nitrogen content, a carbon content, a raw material, and a raw material, a melting temperature, dissolution time amount, a dissolution ambient atmosphere, and a melting object, the existence of mixing of an impurity, the class of crucible, the amount of dissolution glass, etc., it is appropriate for them to choose these conditions suitably and to manufacture them.

[0012] In the manufacture approach of oxy-carbonite RAIDO glass For example, SiO_2, MgO, CaO, Y_2O_3, and aluminum2O3, as a raw material metallic oxides, such as Li_2O, and aluminum2N2, AlN, BN and Si_3N_4 etc. — a metal nitride and Mg_2C, aluminum4C3, and SiC etc. — the mixture of metallic carbide, a metallic oxide, and a metal nitride, the mixture of a metallic oxide and metallic carbide, etc. can be used. In addition, as a metallic oxide, the carbonate which can form these metallic oxides by the pyrolysis, a hydroxide, an oxalate, etc. can also be used as a raw material. moreover, metal nitrogen oxides, such as Si_2N_2O and aluminum2NO3, and $CaCO_3$ and $MgCO_3$ etc. — a metal carbonate can also be used as a raw material. These raw materials are fully mixed, it is fusing and oxy-carbonite RAIDO glass is obtained. As for melting of mixture, at this time, it is desirable in a 1400-1900-degree C temperature requirement to carry out under inert gas ambient atmospheres, such as nitrogen or an argon, for about 1 to 50 hours, and to vitrify after melting. After founding, by approaches, such as well-known press molding and down draw molding, the vitrified oxy-carbonite RAIDO glass is cast by tabular glass, and after that, processing of grinding, polish, etc. is performed and let it be desired size and the substrate of a configuration.

[0013] In addition, at polish, surface precision can be made into the range of 3-8A by Ra by performing polishing (precision polish) by abrasive powder, such as wrapping (sand credit) and sodium oxide. In addition, in the glass of this invention, as long as it is the range which does not worsen the surface smooth nature of a substrate, some glass may be crystallized by heat-treating glass at temperature higher than the transition point temperature, without adding crystallization generation agents, such as TiO_2 and ZrO_2, on glass, or adding a crystal nucleation agent. Moreover, it is good also as the glass containing the component of the nitrogen system ceramics or the carbon system ceramics, or glass including the condition of having resembled the sintering nitrogen system ceramics and the sintering carbon system ceramics. Furthermore, as for the glass substrate of this invention, transparence and any translucent and opaque mode are contained. Furthermore, it is Si_3N_4 in glass. Fiber and SiC A fiber or reinforcement, such as ceramic fiber, such as fiber and an alumina fiber, carbon fiber, a boron fiber, a glass fiber, and various whiskers, may be put in, and the advanced dynamics property in a pyrosphere may be given.

[0014] In this invention, texture ring processing may be performed with means, such as etching processing, and membrane formation or a laser light exposure, on the surface of a glass substrate if needed. Wet etching can specifically be carried out with the etching reagent which consists of mixed liquor of hydrofluoric acid and a nitric acid on the surface of a glass substrate, irregularity can be attached to a glass front face, and texture ring processing can be performed. Moreover, texture ring processing can be performed to a glass front face by preparing concavo-convex film, such as aluminum, on the surface of a glass substrate. In addition, since it excels in thermal resistance, surface smooth nature, chemistry endurance, optical property, a degree of hardness, and reinforcement, the glass substrate of this invention mentioned above can be suitably used also as a glass substrate for glass substrates for electron optics, such as an optical disk, the heat-resisting-glass substrate for low-temperature polycrystalline silicon liquid crystal displays expected as the next generation LCD or the electrical and electric equipment, and electronic parts.

[0015]

[Effect of the Invention] Since the substrate of this invention consists of oxy-carbonite RAIDO glass, it excels in thermal resistance, endurance, and surface smooth nature, and the glass substrate for magnetic-recording media with large reinforcement

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can be offered. Especially according to this invention, it is 100GPa. It has big Young's modulus or a high specific Young's modulus more than 36 (106 Nm/kg), and the high thermal resistance of 700 degrees C or more above, and has the outstanding surface smooth nature (surface roughness Ra<8A), and the glass substrate for magnetic-recording media with large reinforcement can be offered. Moreover, since heat treatment required for the improvement in a property of the magnetic film can be performed without deformation of a substrate since the glass substrate of this invention is excellent in thermal resistance, and it excels in surface smoothness, since a specific Young's modulus and reinforcement are large, while it can attain low floatation-ization of the magnetic head, i.e., the formation of high density record, and being able to attain thin shape-ization of a magnetic disk, breakage of a magnetic disk is also avoided. Furthermore, it can obtain to stability comparatively also as glass, and since production on industrial magnitude is easy, it is greatly expectable as substrate glass for next-generation magnetic-recording media.

[0016]

[Example] Hereafter, an example explains this invention further.

The glass presentation of examples 1-3 was shown in one to example 3 table 1 by mol %. As the start raw material at the time of dissolving these glass, SiO2, aluminum 2O3, aluminum (OH)3, MgO, CaCO3, Y2O3, Si3N4, and SiC etc. -- 200-500g weighing capacity was carried out to the predetermined rate which was used and was shown in a table 1, and it fully mixed, and accomplished with the mixing batch, this was put into the molybdenum crucible, and glass was dissolved in the argon ambient atmosphere by 1650 degrees C for about 5 hours using the high-frequency furnace. After fusion, putting glass melt into a crucible, after cooling radiationally to the transition point temperature of glass, it put into the annealing furnace promptly, and it annealed in the transition-temperature range of glass for about 1 hour, cooled radiationally to the room temperature in the furnace, and glass was obtained.

[0017] After grinding glass to 30x10x10mm, 10x10x20mm, and 10x1x20mm, it considered as Young's modulus, specific gravity, and the measurement sample of DSC. Disc glass with a phi67mmx thickness of 5mm was ground in phi65x thickness of 0.5mm, and it considered as the measurement sample of surface roughness. Measurement of DSC polished 10x1x20mm tabular glass to the powder of 150 meshes, carried out weighing capacity of the 50mg, put it into the platinum pan, and was performed using MAC-3300 mold DSC equipment. Measurement of Young's modulus was performed with the supersonic method using the 30x10x10mm sample. The data obtained by measurement were shown in a table 1 with the presentation of glass. In addition, a presentation and a property are indicated for the ion-exchange glass substrate indicated by JP,1-239036,A and the glass substrate indicated by JP,7-187711,A to a table 1 as examples 1 and 2 of a comparison, respectively for a comparison.

[0018]

[A table 1]

	モル%	実施例1	実施例2	実施例3	比較例1	比較例2
組成	SiO_2	52.00	45.00	41.5	73.00	52.00
	Al_2O_3	20.00	18.00	20.00	0.60	1.00
	Y_2O_3	2.00	—	—	—	—
	MgO	18.00	20.00	—	—	—
	CaO	—	—	20.00	7.00	16.00
	SiC	3.00	5.00	3.5	—	—
	Si_3N_4	5.00	10.00	15.00	—	—
	Na_2O	—	—	—	9.00	7.00
	K_2O	—	—	—	9.00	5.00
	ZnO	—	—	—	2.00	—
	As_2O_3	—	—	—	0.20	—
	F	—	—	—	—	19.00
	炭素含有量（wt%）	0.5	1.50	1.01	—	—
	窒素含有量（wt%）	2.00	4.00	6.00	—	—
特性	ガラス転移点（℃）	870	930	942	554	—
	比重（g/cm^3）	2.81	2.80	2.89	2.60	2.60
	ヤング率（GPa）	129	138	145	79	91
	比弾性率（10^6Nm/kg）	45.9	49.3	50.1	30.3	35
	曲げ強度（kg/mm^2）	400	420	390	27	30
	ヌープ硬さ（kg/mm^2）	920	1000	950	550	640
	Ra（Å）	4	5	4	12	25

[0019] Since the glass substrate of examples 1-3 has the high glass transition point, it turns out that there is thermal resistance of extent which can fully respond also to desired heat treatment at 700 degrees C or less of usual, so that clearly from a table 1. Especially, since the strength property of glass, such as Young's modulus and a specific Young's modulus, is large, when it is used as a substrate for magnetic-recording media, even if this glass substrate carries out a high-speed revolution, it turns out that it is hard to produce curvature and Bure in a substrate, and can deal also with thin shape-ization of a substrate more. Furthermore, since the surface roughness (Ra) of these glass can be ground to 8A or less and it excels in surface smooth nature, low floatation-ization of the magnetic head can be attained and it is useful as a glass substrate for magnetic-recording media.

[0020] On the other hand, although the chemically-strengthened-glass substrate of the example 1 of a comparison is excellent in surface smooth nature and surface smoothness, it is considerably inferior compared with the glass substrate of this invention in properties, such as thermal resistance and a specific Young's modulus. Therefore, in case a magnetic-recording medium is manufactured, heat treatment to the magnetic layer which acquires high coercive force and which is performed for accumulating cannot be performed enough, and the magnetic-recording medium which has high coercive force is not obtained. Moreover, the glass-ceramics substrate of the example 2 of a comparison is inferior compared with the glass of this invention in respect of a specific Young's modulus or smooth nature. Since especially the smooth nature of a substrate is spoiled by existence of a big crystal grain child, high density record-ization cannot be attained. The above thing the substrate which consists of oxy-carbonite RAIDO glass which it is desirable that the mechanical property is excellent and has the high specific Young's modulus of this invention and high thermal resistance is physical or dramatically useful that was mentioned above, in order to use it as a substrate for magnetic-recording media.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the glass substrate for magnetic-recording media and the glass substrate for information record media which used oxy-carbonite RAIDO glass.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since the substrate of this invention consists of oxy-carbonite RAIDO glass, it excels in thermal resistance, endurance, and surface smooth nature, and the glass substrate for magnetic-recording media with large reinforcement can be offered. Especially according to this invention, it is 100GPa. It has big Young's modulus or a high specific Young's modulus more than 36 (106 Nm/kg), and the high thermal resistance of 700 degrees C or more above, and has the outstanding surface smooth nature (surface roughness Ra<8A), and the glass substrate for magnetic-recording media with large reinforcement can be offered. Moreover, since heat treatment required for the improvement in a property of the magnetic film can be performed without deformation of a substrate since the glass substrate of this invention is excellent in thermal resistance, and it excels in surface smoothness, since a specific Young's modulus and reinforcement are large, while it can attain low floatation-ization of the magnetic head, i.e., the formation of high density record, and being able to attain thin shape-ization of a magnetic disk, breakage of a magnetic disk is also avoided. Furthermore, it can obtain to stability comparatively also as glass, and since production on industrial magnitude is easy, it is greatly expectable as substrate glass for next-generation magnetic-recording media.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, in connection with the miniaturization of the latest HDD (Hard disk driver), thin-shape-izing, and the densification of magnetic recording, the reduction in floatation of the magnetic head and high-speed revolution-ization of a magnetic disk are progressing quickly. Therefore, the reinforcement of a disk substrate, an elastic modulus, surface smoothness, etc. have been required still more severely. It is inevitable that high-capacity-izing of HDD, a miniaturization, and the demand to a shock resistant will increase further from now on, and it is certain that the demand which thin-shape-izing, high intensity, the outstanding surface surface smoothness, high shock resistance, etc. receive as a substrate ingredient for magnetic-recording media increases further. Therefore, with conventional chemically strengthened glass which is indicated by the JP,1-239036,A official report, elastics modulus are about 80 GPa(s). There is a possibility that it may become impossible to correspond to the severe demand of future HDD with extent. Moreover, if the chemically-strengthened-glass substrate is not formed so that the stress layer of front flesh-side both sides may have homogeneity and equivalent stress, it has the fault which produces the curvature of a substrate. Furthermore, in the manufacture process of the medium of magnetic recording, after preparing a magnetic layer on a glass substrate, in order to raise properties, such as coercive force of a magnetic layer, predetermined heat treatment may be performed, but with the above-mentioned conventional ion-exchange tempered glass, since the transition point temperature of glass is also lacking in about 500 degrees C and thermal resistance, there is a problem that high coercive force is not acquired.
[0004] Moreover, the conventional glass ceramics which are indicated by the U.S. Pat. No. 5391522 official report excel the above-mentioned chemically-strengthened-glass substrate in the elastic modulus or the heat-resistant point a little. However, surface roughness is deficient in about at most 10A and surface smoothness at Ra, and a limitation is in low floatation-ization of the magnetic head. Therefore, in the conventional glass ceramics, there is a problem that it cannot respond to the densification of magnetic recording. Moreover, the magnetic-recording medium which, on the other hand, used glacis carbon which is indicated by the JP,3-273525,A official report excels an above-mentioned chemically-strengthened-glass substrate and an above-mentioned glass-ceramics substrate in the point of thermal resistance or lightweight nature, and high density record is expected. However, it is thought that glacis carbon has much surface discontinuity and cannot respond to high density record. Furthermore, an elastic modulus is 30x106 Nm/kg. It is dramatically as low as extent, and since it is inferior to a glass ingredient in respect of a mechanical strength, it is necessary to take the large thickness of a substrate, and there is a problem that it cannot respond to a miniaturization or thin-shape-izing of a substrate.
[0005] Then, this invention was made in consideration of the demand thin-shape-izing of the future substrate for magnetic-recording media, high intensity, high shock-proof one, high heat-resistant, Young's modulus and thermal resistance are high and this invention aims at excelling in surface smooth nature or surface homogeneity, and offering the new glass substrate for magnetic-recording media with large reinforcement. Young's modulus and thermal resistance of this invention are still higher, and also let it be the object to excel in surface smooth nature or surface homogeneity, and to offer the new glass substrate for information record media with large reinforcement.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, as a glass substrate for magnetic disks for which high intensity and high shock resistance are needed, the tempered glass substrate which strengthened the substrate front face with the ion-exchange method, the glass-ceramics substrate which performed crystallization processing are known. As a tempered glass substrate, there is a glass substrate for magnetic disks indicated by JP,1-239036,A, for example. This glass substrate is 50 - 65%, and aluminum 2O3 about SiO_2 by weight % display. It is the glass substrate which formed the compressive-stress layer and was strengthened by the substrate front face of the glass which contains [R_2O (however, R alkali metal)] B-2 O3 for ZnO 1.1 to 14% 1 to 15% 10 to 32% by the ion-exchange method by alkali ion 0.5 to 14%. Moreover, as a crystallization glass substrate, there is a glass-ceramics substrate for magnetic disks indicated by the U.S. Pat. No. 5391522 official report, for example. This glass substrate is 8 - 13%, and K_2O about 65 - 83%, and Li_2O in SiO_2 by weight % display. They are 0 - 5%, and PbO about 0.5 - 5.5%, and ZnO in 0 - 7%, and MgO, 0 - 5% (however, MgO+ZnO+PbO 0.5 - 5%) They are 1 - 4%, and aluminum 2O3 about P_2O_5. 0 - 7%, and As_2O_3+Sb 2O3 It contains 0 to 2% and they are Li_2O and $2SiO_2$ detailed as a main crystal. It consists of glass ceramics including a crystal grain child.

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MEANS

[Means for Solving the Problem] In order to attain the above-mentioned object, this invention is a substrate for magnetic-recording media characterized by consisting of oxy-carbonite RAIDO glass. Furthermore, this invention relates to the substrate for information record media characterized by consisting of oxy-carbonite RAIDO glass.
[0007]
[The mode of implementation of invention] The glass substrate of this invention is explained. Oxy-carbonite RAIDO glass is glass which contained a nitride and carbide on oxide glass, is also called acid carbon nitride (Oxycarbonitride) glass, and incorporates nitrogen ion and carbon ion in the structure. Oxy-carbonite RAIDO glass has the structure permuted with trivalent nitrogen ion and tetravalent carbon ion in some oxygen ion of the bivalence in oxide glass. For this reason, from oxide glass, many chemical bonds are formed between glass formers, and the network structure of glass becomes firmer. For this reason, it has the physical property which was [show / high Young's modulus a high degree of hardness, and high intensity] excellent, and has the property which was excellent as the substrate for magnetic-recording media, or a substrate for information record media.
[0008] The class of oxy-carbonite RAIDO glass, a component, and especially a presentation are not restricted. Oxy-carbonite RAIDO glass can change chemical composition continuously, and the element of most periodic tables goes into these structure of glass depending on an addition. Moreover, especially the nitrogen content and carbon content in oxy-carbonite RAIDO glass are not restricted, either. This is because physical properties may improve by leaps and bounds by physical properties improving by leaps and bounds with few nitrogen and carbon contents depending on a presentation system, and making [many] nitrogen and a carbon content at reverse, or considering as a suitable amount.
[0009] As for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint of high shock resistance to high intensity and a specific Young's modulus are more than 36x106 Nm/kg. For the substrate which furthermore consists of oxy-carbonite RAIDO glass of this invention, the viewpoint of high shock resistance to high intensity and Young's modulus are 100GPa(s). It is desirable that it is above. Moreover, as for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint of high surface smooth nature and surface homogeneity to surface roughness (Ra) is 8A or less. Moreover, as for the substrate which consists of oxy-carbonite RAIDO glass of this invention, it is desirable that the viewpoint that thermal resistance is high to a glass transition point is 700 degrees C or more. The glass which has each above-mentioned physical properties can be suitably chosen from the oxy-carbonite RAIDO glass illustrated below.
[0010] As oxy-carbonite RAIDO glass, for example A Li-Si-O-N-C system, A Na-Si-O-N-C system, a K-Si-O-N-C system, M-Si-O-N-C (M is alkaline earth metal), A Li-aluminum-Si-O-N-C system, a Na-aluminum-Si-O-N-C system, A K-aluminum-Si-O-N-C system, a Mg-Si-O-N-C system, a calcium-Si-O-N-C system, A Sr-Si-O-N-C system, a Ba-Si-O-N-C system, a Mg-aluminum-Si-O-N-C system, A calcium-aluminum-Si-O-N-C system, a Sr-aluminum-Si-O-N-C system, A Ba-aluminum-Si-O-N-C system, a Y-aluminum-Si-O-N-C system, A B-aluminum-Si-O-N-C system, a La-aluminum-Si-O-N-C system, A Y-Mg-aluminum-Si-O-N-C system, a R-aluminum-Si-O-N-C system (R is a rare earth metal ion), The glass of a presentation of a Nd-aluminum-Si-O-N-C system, a Ce-aluminum-Si-O-N-C system, and a Si-O-N-C system and the glass which consists of a presentation which mixed these two or more presentations can be mentioned. Especially as a glass substrate for magnetic-recording substrates, specific gravity is low in comparison, and Young's modulus is large. The Mg-aluminum-Si-O-N-C system which whose thermal resistance is high and does not have elution of alkali, A calcium-aluminum-Si-O-N-C system, a Y-Mg-aluminum-Si-O-N-C system, A Y-aluminum-Si-O-N-C system, a Mg-Si-O-N-C system, a calcium-Si-O-N-C system, It is desirable to use the glass of a presentation of an aluminum-Si-O-N-C system and a Ce-aluminum-Si-O-N-C system or the oxy-carbonite RAIDO glass which consists of a presentation which mixed these two or more presentations.
[0011] Especially concerning the manufacture approach of oxy-carbonite RAIDO glass, it is not restricted but the various manufacture approaches can be used. for example, melting — high temperature processing of the approach and porous glass which introduce ammonia and carbon dioxide gas into the inside of the body by bubbling is carried out with carbon dioxide gas, and the approach of making this nonporous, the sol-gel method, the CVD method, etc. are known. In addition, since many properties of oxy-carbonite RAIDO glass are influenced with the cooling rate of the class of compound used as the carbon source added as a nitrogen content, a carbon content, a raw material, and a raw material, a melting temperature, dissolution time amount, a dissolution ambient atmosphere, and a melting object, the existence of mixing of an impurity, the class of crucible, the amount of dissolution glass, etc., it is appropriate for them to choose these conditions suitably and to manufacture them.
[0012] In the manufacture approach of oxy-carbonite RAIDO glass For example, SiO_2, MgO, CaO, Y_2O_3, and aluminum2O3, as a raw material metallic oxides, such as Li_2O, and aluminum2N2, AlN, BN and Si_3N_4 etc. — a metal nitride and Mg_2C, aluminum4C3, and SiC etc. — the mixture of metallic carbide, a metallic oxide, and a metal nitride, the mixture of a metallic oxide and metallic carbide, etc. can be used. In addition, as a metallic oxide, the carbonate which can form these metallic oxides by the pyrolysis, a hydroxide, an oxalate, etc. can also be used as a raw material. moreover, metal nitrogen oxides, such as Si_2N_2O and aluminum2NO3, and $CaCO_3$ and $MgCO_3$ etc. — a metal carbonate can also be used as a raw material. These raw materials are fully mixed, it is fusing and oxy-carbonite RAIDO glass is obtained. As for melting of mixture, at this time, it is desirable in a 1400-1900-degree C temperature requirement to carry out under inert gas ambient atmospheres, such as nitrogen or an argon, for about 1 to 50 hours, and to vitrify after melting. After founding, by approaches, such as well-known press molding and down draw molding, the vitrified oxy-carbonite RAIDO glass is cast by tabular glass, and after that, processing of grinding, polish, etc. is performed and let it be desired size and the substrate of a configuration.
[0013] In addition, at polish, surface precision can be made into the range of 3-8A by Ra by performing polishing (precision polish)

by abrasive powder, such as wrapping (sand credit) and sodium oxide. In addition, in the glass of this invention, as long as it is the range which does not worsen the surface smooth nature of a substrate, some glass may be crystallized by heat-treating glass at temperature higher than the transition point temperature, without adding crystallization generation agents, such as TiO2 and ZrO2, on glass, or adding a crystal nucleation agent. Moreover, it is good also as the glass containing the component of the nitrogen system ceramics or the carbon system ceramics, or glass including the condition of having resembled the sintering nitrogen system ceramics and the sintering carbon system ceramics. Furthermore, as for the glass substrate of this invention, transparence and any translucent and opaque mode are contained. Furthermore, it is Si3N4 in glass. Fiber and SiC A fiber or reinforcement, such as ceramic fiber, such as fiber and an alumina fiber, carbon fiber, a boron fiber, a glass fiber, and various whiskers, may be put in, and the advanced dynamics property in a pyrosphere may be given.

[0014] In this invention, texture ring processing may be performed with means, such as etching processing, and membrane formation or a laser light exposure, on the surface of a glass substrate if needed. Wet etching can specifically be carried out with the etching reagent which consists of mixed liquor of hydrofluoric acid and a nitric acid on the surface of a glass substrate, irregularity can be attached to a glass front face, and texture ring processing can be performed. Moreover, texture ring processing can be performed to a glass front face by preparing concavo-convex film, such as aluminum, on the surface of a glass substrate. In addition, since it excels in thermal resistance, surface smooth nature, chemistry endurance, optical property, a degree of hardness, and reinforcement, the glass substrate of this invention mentioned above can be suitably used also as a glass substrate for glass substrates for electron optics, such as an optical disk, the heat-resisting-glass substrate for low-temperature polycrystalline silicon liquid crystal displays expected as the next generation LCD or the electrical and electric equipment, and electronic parts.

[Translation done.]

* NOTICES *

EXAMPLE

[Example] Hereafter, an example explains this invention further.
The glass presentation of examples 1-3 was shown in one to example 3 table 1 by mol %. As the start raw material at the time of dissolving these glass, SiO_2, aluminum 2O3, aluminum $(OH)_3$, MgO, $CaCO_3$, Y_2O_3, Si_3N_4, and SiC etc. -- 200-500g weighing capacity was carried out to the predetermined rate which was used and was shown in a table 1, and it fully mixed, and accomplished with the mixing batch, this was put into the molybdenum crucible, and glass was dissolved in the argon ambient atmosphere by 1650 degrees C for about 5 hours using the high-frequency furnace. After fusion, putting glass melt into a crucible, after cooling radiationally to the transition point temperature of glass, it put into the annealing furnace promptly, and it annealed in the transition-temperature range of glass for about 1 hour, cooled radiationally to the room temperature in the furnace, and glass was obtained.
[0017] After grinding glass to 30x10x10mm, 10x10x20mm, and 10x1x20mm, it considered as Young's modulus, specific gravity, and the measurement sample of DSC. Disc glass with a phi67mmx thickness of 5mm was ground in phi65x thickness of 0.5mm, and it considered as the measurement sample of surface roughness. Measurement of DSC polished 10x1x20mm tabular glass to the powder of 150 meshes, carried out weighing capacity of the 50mg, put it into the platinum pan, and was performed using MAC-3300 mold DSC equipment. Measurement of Young's modulus was performed with the supersonic method using the 30x10x10mm sample. The data obtained by measurement were shown in a table 1 with the presentation of glass. In addition, a presentation and a property are indicated for the ion-exchange glass substrate indicated by JP,1-239036,A and the glass substrate indicated by JP,7-187711,A to a table 1 as examples 1 and 2 of a comparison, respectively for a comparison.
[0018]
[A table 1]

モル%		実施例1	実施例2	実施例3	比較例1	比較例2
組成	SiO_2	52.00	45.00	41.5	73.00	52.00
	Al_2O_3	20.00	18.00	20.00	0.60	1.00
	Y_2O_3	2.00	—	—	—	—
	MgO	18.00	20.00	—	—	—
	CaO	—	—	20.00	7.00	16.00
	SiC	3.00	5.00	3.5	—	—
	Si_3N_4	5.00	10.00	15.00	—	—
	Na_2O	—	—	—	9.00	7.00
	K_2O	—	—	—	9.00	5.00
	ZnO	—	—	—	2.00	—
	As_2O_3	—	—	—	0.20	—
	F	—	—	—	—	19.00
	炭素含有量 (wt%)	0.5	1.50	1.01	—	—
	窒素含有量 (wt%)	2.00	4.00	6.00	—	—
特性	ガラス転移点 (℃)	870	930	942	554	—
	比重 (g/cm^3)	2.81	2.80	2.89	2.60	2.60
	ヤング率 (GPa)	129	138	145	79	91
	比弾性率 (10^6Nm/kg)	45.9	49.3	50.1	30.3	35
	曲げ強度 (kg/mm^2)	400	420	390	27	30
	ヌープ硬さ (kg/mm^2)	920	1000	950	550	640
	Ra (Å)	4	5	4	12	25

[0019] Since the glass substrate of examples 1-3 has the high glass transition point, it turns out that there is thermal resistance of extent which can fully respond also to desired heat treatment at 700 degrees C or less of usual, so that clearly from a table 1. Especially, since the strength property of glass, such as Young's modulus and a specific Young's modulus, is large, when it is used as a substrate for magnetic-recording media, even if this glass substrate carries out a high-speed revolution, it turns out that it is hard to produce curvature and Bure in a substrate, and can deal also with thin shape-ization of a substrate more. Furthermore, since the surface roughness (Ra) of these glass can be ground to 8A or less and it excels in surface smooth nature, low floatation-ization of the magnetic head can be attained and it is useful as a glass substrate for magnetic-recording media.

[0020] On the other hand, although the chemically-strengthened-glass substrate of the example 1 of a comparison is excellent in surface smooth nature and surface smoothness, it is considerably inferior compared with the glass substrate of this invention in properties, such as thermal resistance and a specific Young's modulus. Therefore, in case a magnetic-recording medium is manufactured, heat treatment to the magnetic layer which acquires high coercive force and which is performed for accumulating cannot be performed enough, and the magnetic-recording medium which has high coercive force is not obtained. Moreover, the glass-ceramics substrate of the example 2 of a comparison is inferior compared with the glass of this invention in respect of a specific Young's modulus or smooth nature. Since especially the smooth nature of a substrate is spoiled by existence of a big crystal grain child, high density record-ization cannot be attained. The above thing the substrate which consists of oxy-carbonite RAIDO glass which it is desirable that the mechanical property is excellent and has the high specific Young's modulus of this invention and high thermal resistance is physical or dramatically useful that was mentioned above, in order to use it as a substrate for magnetic-recording media.

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(54)【発明の名称】　磁気記録媒体用ガラス基板

(57)【要約】

【課題】　ヤング率や耐熱性が高く、表面平滑性や表面均質性に優れ、かつ強度の大きい新たな磁気記録媒体用及び情報記録媒体のガラス基板の提供。

【解決手段】　例えば、Li-Si-O-N-C 系ガラス、Na-Si-O-N-C 系ガラス、Mg-Si-Al-O-N-C系ガラス、Ca-Si-Al-O-N-C系ガラス等のオキシカーボナイトライドガラスからなる磁気記録媒体用基板及び情報記録媒体用基板。この基板は、例えば、比弾性率／３６×１０⁶ Nm/kg 以上であり、ヤング率が100GPa以上であり、表面粗さ(Ra)が５Å以下であり、またはガラス転移点が７００℃以上である。

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【特許請求の範囲】

【請求項１】 オキシカーボナイトライドガラスからなることを特徴とする磁気記録媒体用基板。

【請求項２】 比弾性率が３６×１０^6 Nm／kg以上であることを特徴とする請求項１記載の基板。

【請求項３】 ヤング率が１００GPa 以上であることを特徴とする請求項１記載の基板。

【請求項４】 表面粗さ（Ra）が８Å以下である請求項１～３のいずれか１項に記載の基板。

【請求項５】 ガラス転移点が７００℃以上である請求項１～４のいずれか１項に記載の基板。

【請求項６】 オキシカーボナイトライドガラスが、Li－Si－Ｏ－Ｎ－Ｃ系、Na－Si－Ｏ－Ｎ－Ｃ系、Ｋ－Si－Ｏ－Ｎ－Ｃ系、Li－Al－Si－Ｏ－Ｎ－Ｃ系、Na－Al－Si－Ｏ－Ｎ－Ｃ系、Ｋ－Al－Si－Ｏ－Ｎ－Ｃ系、Mg－Si－Ｏ－Ｎ－Ｃ系、Ca－Si－Ｏ－Ｎ－Ｃ系、Sr－Si－Ｏ－Ｎ－Ｃ系、Ba－Si－Ｏ－Ｎ－Ｃ系、Mg－Al－Si－Ｏ－Ｎ－Ｃ系、Ca－Al－Si－Ｏ－Ｎ－Ｃ系、Sr－Al－Si－Ｏ－Ｎ－Ｃ系、Ba－Al－Si－Ｏ－Ｎ－Ｃ系、Ｙ－Al－Si－Ｏ－Ｎ－Ｃ系、Ｂ－Al－Si－Ｏ－Ｎ－Ｃ系、La－Al－Si－Ｏ－Ｎ－Ｃ系、Ｒ－Al－Si－Ｏ－Ｎ－Ｃ系（Ｒは希土類金属イオン）、Ce－Al－Si－Ｏ－Ｎ－Ｃ系、若しくはSi－Ｏ－Ｎ－Ｃ系の組成からなるガラス、または上記組成を二つ以上混合した組成からなるガラスであることを特徴とする請求項１～５のいずれか１項に記載の基板。

【請求項７】 オキシカーボナイトライドガラスからなることを特徴とする情報記録媒体用基板。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、オキシカーボナイトライドガラスを用いた磁気記録媒体用ガラス基板及び情報記録媒体用ガラス基板に関する。

【０００２】

【従来の技術】従来、高強度や高耐衝撃性を必要とされる磁気ディスク用ガラス基板としては、基板表面をイオン交換法で強化した強化ガラス基板や、結晶化処理を施した結晶化ガラス基板などが知られている。強化ガラス基板としては、例えば、特開平１－２３９０３６号公報に開示された磁気ディスク用ガラス基板がある。このガラス基板は、重量%表示で、SiO_2を５０～６５%、Al_2O_3を0.5～１４%、R_2O（ただしＲはアルカリ金属）を１０～３２%、 ZnOを１～１５%、B_2O_3を1.1～１４%含むガラスの基板表面に、アルカリイオンによるイオン交換法によって圧縮応力層を形成し強化されたガラス基板である。また、結晶化ガラス基板としては、例えば、米国特許５３９１５２２公報に開示された磁気ディスク用結晶化ガラス基板がある。このガラス基板は、重量%表示で、SiO_2を６５～８３%、Li_2Oを８～１３%、K_2Oを０～７%、 MgOを0.5～5.5%、 ZnOを０～５%、 PbOを０～５%（ただしMgO+ZnO+PbO を0.5～５%）、P_2O_5を１～４%、Al_2O_3 を０～７%、As_2O_3+Sb_2O_3 を０～２%含み、主結晶として微細な$Li_2O\cdot 2SiO_2$ 結晶粒子を含む結晶化ガラスからなる。

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【０００３】

【発明が解決しようとする課題】しかしながら、最近のＨＤＤ（Hard disk driver）の小型化、薄型化、磁気記録の高密度化に伴って、磁気ヘッドの低浮上化及び磁気ディスクの高速回転化が急速に進んでいる。そのため、ディスク基板の強度や弾性率、表面平滑度などが一層厳しく要求されてきている。今後、ＨＤＤの高容量化、小型化、耐衝撃に対する要求がさらに高まるのは必至であり、磁気記録媒体用基板材料としては薄型化、高強度、優れた表面平坦性、高耐衝撃性などが対する要求がさらに高まることは間違いない。そのため、特開平１－２３９０３６公報に開示されているような従来の化学強化ガラスでは、弾性率が約８０GPa 程度で今後のＨＤＤの厳しい要求に対応できなくなる恐れがある。また、化学強化ガラス基板は表裏両面の応力層が均一かつ同等の応力をもつように形成されていないと基板の反りを生じる欠点がある。さらに、磁気記録の媒体の製造過程においては、ガラス基板上に磁性層を設けた後に、磁性層の保磁力等の特性を向上させるために所定の熱処理を施される場合があるが、上記従来のイオン交換強化ガラスではガラスの転移点温度も５００℃程度と耐熱性に乏しいので、高保磁力が得られないという問題がある。

【０００４】また、米国特許５３９１５２２公報に開示されているような従来の結晶化ガラスは、弾性率や耐熱性の点では、上記の化学強化ガラス基板より少々優れている。しかるに、表面粗さがRaでせいぜい１０Å程度と、表面平滑度が乏しく、磁気ヘッドの低浮上化に限界がある。そのため、従来の結晶化ガラスでは、磁気記録の高密度化に対応できないという問題がある。また一方、特開平３－２７３５２５公報に開示されているようなグラシカーボンを利用した磁気記録媒体は、耐熱性や軽量性の点では上記の化学強化ガラス基板や結晶化ガラス基板より優れており、高密度記録が期待される。しかるに、グラシカーボンは表面欠陥が多く、高密度記録には対応できないと考えられる。さらに、弾性率が３０×１０^6 Nm/kg 程度と非常に低く、機械的強度の点ではガラス材料より劣るため、基板の厚みを大きくとる必要があり、基板の小型化や薄型化に対応できないという問題がある。

【０００５】そこで、本発明は将来の磁気記録媒体用基板の薄型化、高強度、高耐衝撃性、高耐熱性などの要求を考慮してなされたもので、本発明は、ヤング率や耐熱性が高く、表面平滑性や表面均質性に優れ、かつ強度の大きい新たな磁気記録媒体用のガラス基板を提供することを目的とする。さらに本発明は、ヤング率や耐熱性が高く、表面平滑性や表面均質性に優れ、かつ強度の大きい新たな情報記録媒体用のガラス基板を提供することも

目的とする。

【０００６】

【課題を解決するための手段】上記の目的を達成するために本発明は、オキシカーボナイトライドガラスからなることを特徴とする磁気記録媒体用基板である。さらに本発明は、オキシカーボナイトライドガラスからなることを特徴とする情報記録媒体用基板に関する。

【０００７】

【発明の実施の態様】本発明のガラス基板について説明する。オキシカーボナイトライドガラスは、酸化物ガラスに窒化物及び炭化物を含有したガラスで、酸炭窒化物（Oxycarbonitride ）ガラスとも呼ばれ、窒素イオンと炭素イオンをその構造に取り込んだものである。オキシカーボナイトライドガラスは、酸化物ガラス中の二価の酸素イオンの一部を三価の窒素イオンと四価の炭素イオンにより置換された構造を有する。このため、酸化物ガラスよりガラスフォーマとの間に多くの化学結合が形成されてガラスの網目構造がもっと強固になる。このため、高ヤング率、高硬度、高強度を示すなどの優れた物理的性質を有し、磁気記録媒体用基板や情報記録媒体用基板として優れた特性を有する。

【０００８】オキシカーボナイトライドガラスの種類、成分、組成は、特に制限されない。オキシカーボナイトライドガラスは、化学組成を連続的に変化させることができ、添加量によっては周期表の大部分の元素がこれらのガラスの構造に入る。また、オキシカーボナイトライドガラス中の窒素含有量及び炭素含有量も特に制限されない。これは組成系によっては、わずかな窒素及び炭素含有量で物性が飛躍的に向上する場合もあるし、逆に窒素及び炭素含有量を多くして又は適当量とすることで物性が飛躍的に向上する場合もあるからである。

【０００９】本発明のオキシカーボナイトライドガラスからなる基板は、高強度、高耐衝撃性という観点から比弾性率が３６×１０^6 Nm／kg以上であることが好ましい。さらに本発明のオキシカーボナイトライドガラスからなる基板は、高強度、高耐衝撃性という観点からヤング率が１００GPa 以上であることが好ましい。また本発明のオキシカーボナイトライドガラスからなる基板は、高い表面平滑性、表面均質性という観点から、表面粗さ（Ra）が８Å以下であることが好ましい。また本発明のオキシカーボナイトライドガラスからなる基板は、耐熱性が高いという観点から、ガラス転移点が７００℃以上であることが好ましい。上記各物性を有するガラスは、以下に例示するオキシカーボナイトライドガラスから適宜選択することができる。

【００１０】オキシカーボナイトライドガラスとしては、例えば、Li－Si－Ｏ－Ｎ－Ｃ系、Na－Si－Ｏ－Ｎ－Ｃ系、Ｋ－Si－Ｏ－Ｎ－Ｃ系、Ｍ－Si－Ｏ－Ｎ－Ｃ（Ｍはアルカリ土類金属）、Li－Al－Si－Ｏ－Ｎ－Ｃ系、Na－Al－Si－Ｏ－Ｎ－Ｃ系、Ｋ－Al－Si－Ｏ－Ｎ－Ｃ系、

Mg－Si－Ｏ－Ｎ－Ｃ系、Ca－Si－Ｏ－Ｎ－Ｃ系、Sr－Si－Ｏ－Ｎ－Ｃ系、Ba－Si－Ｏ－Ｎ－Ｃ系、Mg－Al－Si－Ｏ－Ｎ－Ｃ系、Ca－Al－Si－Ｏ－Ｎ－Ｃ系、Sr－Al－Si－Ｏ－Ｎ－Ｃ系、Ba－Al－Si－Ｏ－Ｎ－Ｃ系、Ｙ－Al－Si－Ｏ－Ｎ－Ｃ系、Ｂ－Al－Si－Ｏ－Ｎ－Ｃ系、La－Al－Si－Ｏ－Ｎ－Ｃ系、Ｙ－Mg－Al－Si－Ｏ－Ｎ－Ｃ系、Ｒ－Al－Si－Ｏ－Ｎ－Ｃ系（Ｒは希土類金属イオン）、Nd－Al－Si－Ｏ－Ｎ－Ｃ系、Ce－Al－Si－Ｏ－Ｎ－Ｃ系、Si－Ｏ－Ｎ－Ｃ系の組成のガラス、及びこれらの組成を二つ以上混合した組成からなるガラスを挙げることができる。特に、磁気記録基板用ガラス基板としては、比重が比較的に低く、ヤング率が大きく、耐熱性が高く、かつアルカリの溶出のないMg－Al－Si－Ｏ－Ｎ－Ｃ系、Ca－Al－Si－Ｏ－Ｎ－Ｃ系、Ｙ－Mg－Al－Si－Ｏ－Ｎ－Ｃ系、Ｙ－Al－Si－Ｏ－Ｎ－Ｃ系、Mg－Si－Ｏ－Ｎ－Ｃ系、Ca－Si－Ｏ－Ｎ－Ｃ系、Al－Si－Ｏ－Ｎ－Ｃ系、Ce－Al－Si－Ｏ－Ｎ－Ｃ系の組成のガラス、またはこれらの組成を二つ以上混合した組成からなるオキシカーボナイトライドガラスを用いることが好ましい。

【００１１】オキシカーボナイトライドガラスの製造方法に関しては、特に制限されず、各種製造方法を利用できる。例えば、溶融体中にアンモニア及び炭酸ガスをバブリングで導入する方法、多孔質ガラスを炭酸ガスで高温処理し、これを無孔化する方法、ゾルーゲル法、ＣＶＤ法などが知られている。なお、オキシカーボナイトライドガラスの諸特性は、窒素含有量、炭素含有量、原料、原料として加える炭素源となる化合物の種類、溶解温度、溶解時間、溶解雰囲気、溶融体の冷却速度、不純物の混入の有無、るつぼの種類、溶解ガラスの量などによって影響を受けるので、これらの条件を適宜に選択して製造することが適当である。

【００１２】オキシカーボナイトライドガラスの製造方法においては、例えば、原料としてSiO_2、 MgO、CaO 、Y_2O_3 、Al_2O_3 、Li_2Oなどの金属酸化物や、Al_2N_2 、AlN 、BN、Si_3N_4 などの金属窒化物、及びMg_2C、Al_4C_3 、SiC などの金属炭化物、金属酸化物と金属窒化物との混合物及び金属酸化物と金属炭化物との混合物などを使用することができる。尚、金属酸化物としては、熱分解によりこれらの金属酸化物を形成できる炭酸塩、水酸化物、シュウ酸塩などを原料とすることもできる。また、Si_2N_2O、Al_2NO_3など金属窒素酸化物や$CaCO_3$ 、$MgCO_3$ などの金属炭酸塩も原料として使用できる。これらの原料は十分に混合し、溶融することで、オキシカーボナイトライドガラスが得られる。このとき、混合物の溶融は、例えば、１４００～１９００℃の温度範囲において、１～５０時間程度、窒素またはアルゴンなどの不活性ガス雰囲気下にて行い、溶融後ガラス化することが好ましい。ガラス化したオキシカーボナイトライドガラスは、清澄後、周知のプレス成型や、ダウンドロー成型などの方法により、板状ガラスに成型され、その後、研削、研

磨などの加工が施され所望のサイズ、形状の基板とされる。

【0013】なお、研磨では、ラッピング（砂掛け）及び酸化ナトリウムなどの研磨粉によるポリシング（精密研磨）を行うことで、表面精度を例えばRaで３～８Åの範囲にすることができる。なお、本発明のガラスにおいては、基板の表面平滑性を悪化させない範囲であれば、ガラスにTiO_2、ZrO_2などの結晶化生成剤を添加するか、或いは、結晶核生成剤を添加せずにガラスをその転移点温度より高い温度で熱処理することによって、ガラスの一部を結晶化させてもよい。また、窒素系セラミックスや炭素系セラミックスの成分を含むガラス、或いは焼結窒素系セラミックスや焼結炭素系セラミックスに似た状態を含むガラスとしてもよい。さらに、本発明のガラス基板は、透明、半透明、不透明のいずれの態様も含まれる。さらに、ガラス中にSi_3N_4繊維、SiC繊維、アルミナ繊維などのセラミックス繊維、カーボン繊維、ボロン繊維、ガラス繊維、各種ウィスカなどのファイバ又は強化材を入れて、高温域における高度の力学特性を付与してもよい。

【0014】本発明では、必要に応じガラス基板の表面に、エッチング処理や成膜、或いはレーザー光照射などの手段でテクスチャリング処理を施してもよい。具体的には、ガラス基板の表面に弗化水素酸と硝酸との混合液よりなるエッチング液で湿式エッチングして、ガラス表面に凹凸を付けテクスチャリング処理を施すことができる。また、ガラス基板の表面に、アルミニウムなどの凹凸膜を設けることで、ガラス表面にテクスチャリング処理を施すことができる。なお、上述した本発明のガラス基板は、耐熱性、表面平滑性、化学耐久性、光学的性質、硬度及び強度に優れているので、光ディスクなどの電子光学用ガラス基板、次世代ＬＣＤとして期待される低温多結晶シリコン液晶表示装置用の耐熱性ガラス基板、或いは電気、電子部品用のガラス基板としても好適に使用できる。

【0015】

【発明の効果】本発明の基板は、オキシカーボナイトライドガラスからなるので、耐熱性、耐久性、表面平滑性に優れ、かつ強度の大きい磁気記録媒体用ガラス基板が提供できる。特に、本発明によれば、１００GPa以上大きなヤング率または３６（10^6 Nm／kg）以上の高い比弾性率及び７００℃以上の高い耐熱性を有し、優れた表面平滑性（表面粗さRa＜８Å）をもち、かつ強度の大きい磁気記録媒体用ガラス基板を提供できる。また、本発明のガラス基板は、耐熱性に優れるため、磁気膜の特性向上に必要な熱処理を基板の変形無しに施すことができ、平坦性に優れるため、磁気ヘッドの低浮上化即ち高密度記録化が達成でき、比弾性率及び強度が大きいので、磁気ディスクの薄型化を達成できると共に磁気ディスクの破損も避けられる。さらにガラスとしても比較的安定に得ることができ、工業的規模での生産が容易であるため、次世代磁気記録媒体用基板ガラスとして大きく期待できる。

【0016】

【実施例】以下、本発明を実施例によりさらに説明する。

実施例１～３

表１には実施例１～３のガラス組成をモル％で示した。これらのガラスを溶解する際の出発原料としては、SiO_2、Al_2O_3、$Al(OH)_3$、MgO、$CaCO_3$、Y_2O_3、Si_3N_4、SiCなどを用いて表１に示した所定の割合に２００～５００ｇ秤量し、十分に混合して調合バッチと成し、これをモリブデンるつぼに入れ、高周波炉を用いて１６５０℃でアルゴン雰囲気で約５時間ガラスの溶解を行った。熔融後、ガラス融液をるつぼに入れたまま、ガラスの転移点温度まで放冷してから直ちにアニール炉に入れ、ガラスの転移温度範囲で約１時間アニールして炉内で室温まで放冷してガラスを得た。

【0017】ガラスを３０×１０×１０mm、１０×１０×２０mm、１０×１×２０mmに研磨した後、ヤング率、比重、ＤＳＣの測定サンプルとした。φ６７mm×厚み５mmの円盤ガラスをφ６５×厚み0.５mmに研磨して表面粗さの測定サンプルとした。ＤＳＣの測定は１０×１×２０mmの板状ガラスを１５０メッシュの粉末に磨き、５０mgを秤量して白金パンに入れ、ＭＡＣ－３３００型ＤＳＣ装置を用いて行われた。ヤング率の測定は３０×１０×１０mmのサンプルを用いて超音波法で行われた。測定で得られたデータをガラスの組成と共に表１に示した。なお、比較のため、特開平１－２３９０３６号に開示されたイオン交換ガラス基板と特開平７－１８７７１１号公報に記載されたガラス基板とをそれぞれ比較例１、２として、表１に組成と特性を記載する。

【0018】

【表１】

モル%		実施例1	実施例2	実施例3	比較例1	比較例2
組成	SiO_2	52.00	45.00	41.5	73.00	52.00
	Al_2O_3	20.00	18.00	20.00	0.60	1.00
	Y_2O_3	2.00	—	—	—	—
	MgO	18.00	20.00	—	—	—
	CaO	—	—	20.00	7.00	16.00
	SiC	3.00	5.00	3.5	—	—
	Si_3N_4	5.00	10.00	15.00	—	—
	Na_2O	—	—	—	9.00	7.00
	K_2O	—	—	—	9.00	5.00
	ZnO	—	—	—	2.00	—
	As_2O_3	—	—	—	0.20	—
	F	—	—	—	—	19.00
	炭素含有量（wt%）	0.5	1.50	1.01	—	—
	窒素含有量（wt%）	2.00	4.00	6.00	—	—
特性	ガラス転移点（℃）	870	930	942	554	—
	比重（g/cm^3）	2.81	2.80	2.89	2.60	2.60
	ヤング率（GPa）	129	138	145	79	91
	比弾性率（$10^6Nm/kg$）	45.9	49.3	50.1	30.3	35
	曲げ強度（kg/mm^2）	400	420	390	27	30
	ヌープ硬さ（kg/mm^2）	920	1000	950	550	640
	Ra（Å）	4	5	4	12	25

【0019】表1から明らかなように、実施例1～3のガラス基板はガラス転移点が高いため、所望の熱処理（通常700℃以下で）に対しても十分に対応できる程度の耐熱性があることが分かる。特に、ヤング率や比弾性率などガラスの強度特性が大きいことから、磁気記録媒体用基板として使用した場合、このガラス基板が高速回転しても、基板に反りやブレが生じにくく、より基板の薄型化にも対応できることが分かる。さらに、これらのガラスの表面粗度（Ra）を8Å以下に研磨することができ、表面平滑性に優れているので、磁気ヘッドの低浮上化を図ることができ、磁気記録媒体用ガラス基板として有用である。

【0020】これに対し、比較例1の化学強化ガラス基板は、表面平滑性及び平坦性に優れているものの、耐熱性や比弾性率などの特性で本発明のガラス基板に比べかなり劣る。従って、磁気記録媒体を製造する際、高い保磁力を得るために行う磁気層に対する熱処理が十分できず、高保磁力を有する磁気記録媒体が得られない。また、比較例2の結晶化ガラス基板は、比弾性率や平滑性の点で本発明のガラスに比べ劣る。特に基板の平滑性が大きな結晶粒子の存在によって損なわれるので、高密度記録化を図ることができない。以上のことから、磁気記録媒体用基板として使用するためには、上述した物理的或いは機械的性質が優れていることが好ましく、本発明の高比弾性率、高耐熱性をもつオキシカーボナイトライドガラスからなる基板が非常に有用であることが分かる。